

Ref #	Image Names	On-Screen Graphics	On-Screen Text	Narration
1.1		Title slide and welcome screen	Substation Access Only: Module 2	Music and no narration
1.2			Title: About this Module  This module covers the substation equipment and work considerations in energized environments.	Welcome back! In module one, you reviewed the safety measures that must be taken before, during, and after you perform work in a substation.  This module covers the various equipment in substations and work considerations in energized environments.  There will be some review questions throughout the program to help prepare you for the final evaluation.
1.3		(Generic Nav instructions)	Title: Navigation	Want to learn about course navigation? Click the NAV button for a walkthrough.
1.4			Let's Get Started Substation Equipment and Work Considerations in Energized Environments	Now, let's get into our second module, Substation Equipment and Work Considerations in Energized Environments
Section: One-Line Diagrams				
2.1	2.1	One-line diagram (fly in under VO)	Title: One-Line Diagrams	We'll begin by reviewing system one-line diagrams. These show all stations, lines, switches, operating voltages, equipment, and how they are connected to circuits 38 kV and above.
2.2	2.2	One-line diagram  Highlight each component as it's mentioned.	Title: Parts of the Diagram	A system one-line diagram consists of symbols, switch, and breaker numbers implied information (e.g., relay scheme associated with substation designs) and other miscellaneous information. System one-line diagrams will normally show a single <b>substation</b> or a single <b>transmission line</b> .  Substation diagrams identify the equipment inside the fence from the primary (transmission voltage) to the secondary (distribution voltage).  Transmission line diagrams show a line from breaker to breaker or from breaker to the end of the line or normal open point. Substation taps (radial lines connected to the main line) are shown from the main line to the substation transformer.
2.3	2.3	Use illustrated Word doc as guide for correct color:  500 kV: green 230 kV: blue 115 kV: orange 69 kV: dark blue 46 kV: fuchsia	Title: Color Coding	Transmission voltages on one-lines are represented by bold lines color-coded in the following way.  Distribution voltages on one-lines are represented by narrow lines and are typically black.

		25 kV and below: black  Use one-line to illustrate last paragraph, highlighting each as narrated.		Voltage levels will also be labeled on each line and at the title block of the drawing located in the lower right of the one-line.  All switches/breakers are color coded to indicate the normal position of the device. Red indicates normally closed and green indicates normally open.
2.4	2.4.1 2.4.2 2.4.3	Photos of switch number plates. Diagram the suffix and prefix when those are mentioned.	Title: Switch Numbering Switch numbers are assigned for all equipment 38 kV and above. Each device has a unique number.  The numbers will consist of blue-black digits on a white background.  A transmission switch number consists of 6 digits.  Distribution switch numbers consist of one letter with four digits or two letters with 3 digits on a red background.  (diagram suffix & prefix)	The System Operator of the Transmission Control Center assigns switch numbers for all equipment 38 kV and above, and for generating plant equipment, regardless of voltage. <ul style="list-style-type: none"> <li>• Each device has a unique number.</li> <li>• The numbers located on or adjacent to the equipment in the field will consist of blue-black digits on a white background.</li> <li>• When switching, a switch must be referred to by its function and complete switch number.</li> </ul> A standard transmission switch number consists of 6 digits. The first 3 digits of a switch number are called the prefix, and they denote the location. The last 3 digits of the switch number are called the suffix, which is the device's unique operating number.  In contrast, distribution switch numbers consist of one letter with four digits or two letters with 3 digits on a red background.
2.5			Review Question	One-line diagrams show what information. Select all that applies. <ul style="list-style-type: none"> <li>✓ Stations</li> <li>✓ lines</li> <li>✓ switches</li> <li>✓ operating voltages</li> <li>✓ equipment</li> </ul> Answer: all boxes checked
2.6			Review Question	What transmission voltage on one-line diagrams is represented by the color black? <ol style="list-style-type: none"> <li>230 kV</li> <li>68 kV</li> <li>25 kV and below</li> <li>115 kV</li> </ol> Answer: c
Section: Components of a Substation				

3.1	3.1		<p>Title: Substation Components</p>	<p>Now that we've refreshed on the purpose and structure of one-line diagrams, let's review the types of equipment you may see in a substation.</p> <p>While you won't be touching, opening, or operating any of this equipment, if you spend time in substations, it's important to recognize and be familiar with the most common equipment and any associated hazards.</p>
3.2	3.2	Various transformer photos	<p>Title: Transformers</p> <p>Transformers are the heart of the substation.</p> <p>They step up or step down voltage to travel across transmission lines or distribute power to customers.</p> <p>If you ever see abnormal activity, such as smoke or leaking oil, stay away and report it to GSOC Transmission Control Center.</p>	<p>First, let's take a look at the transformer. The transformer's function is so crucial that it's often referred to as the "heart of the substation."</p> <p>Transformers step up or step down voltage for traveling across transmission lines (step up) or distributing power to customers (step down).</p> <p>Transformers are oil-filled. If you ever see leaking oil or smoke coming from a transformer, stay away and immediately notify the GSOC Transmission Control Center.</p>
3.3	3.3.1 3.3.2	Transformer diagram highlighting lightning arrestors and bushings	<p>Title: Transformer Components</p> <p>Lightning Arrestors protect from voltage surges.</p> <p>Bushings insulate the conductor from the transformer tank.</p> <p>Report any abnormalities.</p>	<p>Transformers include many components that are crucial to their operation.</p> <p>High and lowside lightning arrestors protect the transformer from voltage surges that could damage the transformer's insulation.</p> <p>Oil-filled high and lowside bushings insulate the conductor from the transformer tank.</p> <p>In your course of work, if you notice shards of broken porcelain, burn marks, or oil, you must report it to the GSOC Transmission Control Center.</p>
3.4	3.4.1 3.4.2 3.4.3	Photo of gauges diagrammed with arrows.	<p>Title: Transformers: Indicators and Gauges</p> <p>Indicators and gauges monitor transformer settings.</p> <p>Qualified operators interpret gauges to troubleshoot potential issues.</p>	<p>Indicators and gauges on the transformer monitor essential transformer settings such as oil &amp; liquid levels, and oil &amp; winding temperatures.</p> <p>Qualified Operators use these gauges to ensure optimal levels and temperatures are maintained and to interpret and troubleshoot potential issues with the transformer.</p>
3.5	3.5		<p>Title: Switches</p> <p>Switches interrupt the flow of power during outages or maintenance.</p> <p>Switches have specific applications any may only be operated by a qualified operator.</p>	<p>Switches are devices that are used to interrupt the flow of power during outages or maintenance activities. Many types of switches are used in a substation, including bare-line de-energizers, automatic interruptors, transrupters, and rated-load break switches. Each switch has a specific application, and switches may only be operated when a qualified operator is authorized through a switching order.</p>

3.6	3.6	Photo(s) of circuit breakers	<p>Title: Circuit Breakers</p> <p>There are oil, gas, and vacuum circuit breakers.</p> <p>Circuit breakers may be used on the high-side to interrupt power during fault conditions to protect the transformer and other equipment.</p>	<p>Another piece of equipment you will see is a circuit breaker. While there are several different types, including oil, gas, and vacuum breakers, they all perform the same basic function. Circuit breakers carry normal load without overheating and damaging themselves, and they quickly open during fault conditions, preventing serious damage to the transformer or other equipment.</p>
3.7	3.7	Voltage regulators with danger icon/sign over them	<p>Title: Voltage Regulators: Safety Precautions</p> <p>Voltage regulators are dangerous when they fail.</p> <p>Take extra safety precautions:</p> <ul style="list-style-type: none"> <li>● Wear correct PPE</li> <li>● Leave area immediately</li> </ul>	<p>Finally, you will see voltage regulators in a substation. It should be noted that they are very dangerous when they fail. When working around voltage regulators, be sure to take the extra safety precautions by wearing the correct PPE (including arc-rated clothing), and leaving the area immediately once your work is complete.</p> <p>If you do not have a reason to be near regulators, stay away.</p>
3.8	3.8.1 3.8.2	Distribution lines	<p>Title: Voltage Regulators: What Voltage Regulators Do</p> <p>Voltage drop:</p> <ul style="list-style-type: none"> <li>● Length and impedance of line</li> <li>● Power factor of the load</li> <li>● Amount of power used by the load</li> <li>● Size and type of conductors</li> </ul> <p>It's important to maintain proper voltage to keep from damaging equipment.</p>	<p>Many things affect voltage drop to the customer: the length and impedance of the line, the power factor of the load, and the amount of power used by the load being served by the line. For example, a load being served by a long line will have a larger voltage drop than a load being served by a short line. The size and type of conductors on the line will also affect the voltage drop.</p> <p>It is important to maintain the proper voltage within certain minimum and maximum levels to keep from damaging the customer's equipment, and that's where voltage regulators come in.</p> <p>A regulator can be used to increase the voltage being supplied to the load. These regulators could be found at the substation or on the distribution line.</p> <p>The voltage output of the regulator is automatically controlled to maintain a certain level of voltage to our customers.</p>
3.9		Photo of substation highlighting which parts are energized	<p>Title: Energized Parts</p>	<p>While you won't be performing work on the substation equipment, having a basic understanding of its appearance, purpose, and hazards is important for your safety and can help you understand which parts of a substation are energized.</p> <p>Let's take a look at this example. Where are the energized parts?</p> <p>Be aware of the flow of power in a substation environment and maintaining your proper</p>

				minimum approach distance from any energized equipment.
Section: Work Considerations				
4.1			<p>Title: Qualification &amp; Authorization</p> <p>Your work still has limitations, and all work must be authorized by GTC.</p> <p>You may:</p> <ul style="list-style-type: none"> <li>● Attend meetings</li> <li>● Perform non-electrical tasks <ul style="list-style-type: none"> <li>○ Deliver materials</li> <li>○ Repair fences</li> <li>○ Apply herbicide</li> <li>○ Mow grass</li> <li>○ Spread gravel</li> <li>○ Oil remediation</li> <li>○ Unload equipment</li> <li>○ Security</li> </ul> </li> </ul> <p>You are NOT permitted to perform switching or operate any substation equipment.</p>	<p>Now that we've reviewed basic substation equipment, let's consider some key guidelines for working in a substation.</p> <p>After completing this Substation Access Only refresher, your authorization to perform work in a substation still has limitations.</p> <p>With prior work authorization from GTC, you may attend meetings at substations, and perform non-electrical tasks, such as delivering materials, repairing fences, applying herbicide or mowing grass, spreading gravel, oil remediation, unloading equipment for project work, or working on a security detail.</p> <p>You are not permitted to perform switching or operate any substation equipment.</p> <p>There may be activities where supervision is needed. These situations, such as replacing drainage structures inside a substation requiring heavy excavation work, demolition of a control house structure, or work utilizing a crane or boom truck, will require a qualified operator to be present.</p>
4.2			<p>Title: Information Transfer/Communication</p> <p>(Show Hazard Information Sheet)</p> <p>The hazard information sheet is used to communicate characteristics of the work site.</p> <p>Whenever you get to a new worksite, review the hazard information sheet. It will allow you to become familiar with the potential hazards at that specific worksite.</p>	<p>GTC completes an in-depth Information Transfer process prior to authorizing any work. The goal of this process is to ensure workers have a clear understanding of the scope of work, the work environment, any potential hazards on the system, and emergency reporting expectations.</p> <p>The hazard information sheet is used to communicate characteristics of the work site.</p> <p>Whenever you get to a new worksite, review the hazard information sheet. It will allow you to become familiar with the potential hazards at that specific worksite.</p> <p>If there is active work occurring at the site, you need to communicate with the person in charge.</p>
4.3			<p>Title: Mobile Substations &amp; Abnormal Conditions</p> <p>If unexpected work is taking place, re-schedule your work, if possible.</p> <p>Significant Maintenance, modification projects, or mobile substations can create additional hazards.</p>	<p>If you arrive at a substation and unexpected, non-routine work is taking place, it may be best to re-schedule your work, if possible.</p> <p>Situations, such as significant maintenance or modification projects, or the presence of a mobile substation, can create an unfamiliar environment and pose additional risks and hazards.</p>

				<p>These situations make it more challenging to identify energized parts and maintain MAD for unqualified workers, and they require advanced training and knowledge of the work to ensure worker safety.</p>
4.4			<p>Work Considerations</p>	<p>Let's talk a little bit about the work tasks you may be completing in a substation.</p> <p>In all work activities, you must be aware that energized lines and equipment are present in the substation. Energized lines and equipment create the potential for an electrical contact and/or contact with induced voltage. You must always be aware of your position and the position of your equipment relative to any energized parts, staying a minimum of 20' away.</p> <p>Click on each of the work processes to learn more about special considerations.</p>
4.5			<p>Title: Loading and Unloading Materials &amp; Equipment</p> <p>Ensure your vehicle has adequate clearance and maintains at least a 20' distance from any energized equipment.</p> <p>Be aware of the space you require.</p> <p>If an overhead crane or boom truck will be used, you will need a qualified operator present.</p>	<p>You may be asked to load or unload materials and equipment associated with substation projects or maintenance work. When you enter the substation, you must ensure your vehicle has adequate clearance and maintains at least a 20' distance from any energized equipment.</p> <p>Be aware of the space you may require to turn around and the height of any lift components.</p> <p>If you are delivering large equipment that requires use of an overhead crane or boom truck, you will need a qualified operator present.</p>
4.6			<p>Title: Proper Storage of Materials</p> <p>Materials must not impede safe entry and exit.</p> <p>Materials should not be stored under energized conductors/overhead lines or near oil-filled equipment.</p> <p>Ensure materials are secure.</p>	<p>Materials or a trailer must be stored in a location where they do not impede safe substation entry and exit.</p> <p>Materials should not be stored underneath energized conductors/overhead lines or near oil-filled equipment. You must get permission from GTC personnel to store materials inside and determine an appropriate location.</p> <p>Ensure materials are properly secured and safe from potential vandalism.</p>
4.7			<p>Title: Operating Heavy Equipment/Lift Equipment</p> <p>Overhead power lines can be a hazard when conductive objects are raised into the air.</p>	<p>Overhead power lines and equipment can be a hazard in any construction project whenever any conductive objects are raised into the air, such as operating cranes and high-lift equipment.</p> <p>Given the importance of minimum approach distance, it is critical that equipment be appropriately sized and scaled for the job.</p>

			<p>Equipment must be properly scaled for the job, and operators must be trained.</p> <p>Consult with an electrically qualified person, and take care of any safety concerns prior to beginning work or the arrival of any heavy equipment.</p>	<p>Additionally, equipment operators must be properly trained and qualified for the job.</p> <p>Consult with an electrically qualified person, and take care of any safety concerns prior to beginning work or the arrival of any heavy equipment in order to prevent accidents and avoid job delays.</p>
4.8		Georgia 811 logo and Digging photo	<p>Title: Digging/Excavation</p> <ul style="list-style-type: none"> <li>You need a dig ticket prior to starting construction.</li> <li>Georgia 811 provides a service called the <b>Positive Response Information System (PRIS)</b> to help you track the status of your locate request.</li> </ul> <p>Hydrovac or non-intrusive digging methods should be used.</p>	<p>In some cases, your substation work may involve digging and excavation. You must get a dig ticket prior to beginning construction activities.</p> <p>Georgia 811 provides a service called the Positive Response Information System (PRIS) to help you track the status of your locate request.</p> <p>Though you are required to have a valid dig ticket/locate, precautions should always be taken by using a hydrovac or non-intrusive digging methods.</p> <p>Ground penetrating radar can be used inside the station to determine the precise location of underground utilities.</p>
4.9		Color Code Guide	<p>Title: Uniform Color Code</p> <p>*show diagram with guide</p>	<p>When utility company representatives mark a location, they use colored flags and/or paint to identify the type of underground utility. Here is what the color codes indicate:</p>
4.10		Screenshot of EDEN application	<p>Title: Checking Status of Dig Ticket</p> <p>To check the status of your locate request, call 888-670-2902.</p> <p>If any line has not been marked by the afternoon of your locate date, please call the Georgia 811 at 811, 1-800-282-7411 or 770-623-4344.</p> <p>You may also download the EDEN application to access <b>PRIS</b> on your phone or iPad.</p>	<p>To check the status of your locate request, call 888-670-2902. If any line has not been marked by the afternoon of your locate date, please call the Georgia 811 at 811, 1-800-282-7411 or 770-623-4344. You may also download the EDEN application to access PRIS on your phone or iPad.</p>
4.11			<p>Title: Spraying</p> <p>Wear proper PPE and never lift anything over chest height.</p> <p>An initial job briefing must be held with GTC.</p> <p>Stay away from energized conductors and equipment. NEVER spray inside a fenced-in capacitor bank.</p>	<p>When spraying herbicide in an energized substation, wear proper PPE and never lift anything over chest height.</p> <p>An initial job briefing must be held with the GTC person-in-charge of work to determine scope of work, site planning/work activities, and appropriate application strategy.</p> <p>Stay away from energized conductors and equipment, and never spray inside a fenced-in capacitor bank.</p>

4.12			Review Question	<p>If applying herbicide inside an energized substation, what precautions should be followed?</p> <ol style="list-style-type: none"> <li>Wear PPE to prevent potential exposure.</li> <li>Never lift anything over chest height.</li> <li>Stay away from energized conductors and equipment.</li> <li>All of above.</li> </ol> <p>Answer: D</p>
4.13				<p>What should you consider when operating machinery or heavy equipment in a substation environment?</p> <ol style="list-style-type: none"> <li>Experience and qualification of equipment operator</li> <li>Proximity to energized parts</li> <li>Size &amp; scale of equipment</li> <li>All the above</li> </ol> <p>Answer: D</p>
Section: ITS/Operating Procedures				
5.1	5.1	ITS substation	<p>Title: ITS Operation</p> <p>Specific PPE and qualification training is required in order to operate equipment on the ITS or enter a substation. A 5-Day Qualified Operator course must be successfully completed to allow you to operate on the system.</p> <p><b>This training does not permit you to operate ANY equipment or enter a transmission line right-of-way.</b></p>	<p>Before we complete training, let's discuss a few of the basics of ITS operation. GTC's transmission lines and substations are part of the Integrated Transmission System, often referred to as the ITS. Specific PPE and qualification training is required in order to operate equipment on the ITS or enter a substation. A 5-Day Qualified Operator course must be successfully completed to allow you to operate on the system. This training does not permit you to operate ANY equipment and only authorizes you to enter substation.</p> <p>In all situations, before beginning any work on a substation, make sure you understand the scope of work and a qualified operator has been involved in the work planning to determine if further operational arrangements should be made.</p> <p>Now, let's review some of the situations you may encounter when working on the ITS, such as clearances and hot line tag orders.</p>
5.2	5.2	The Redbook	<p>Title: The Redbook</p> <p>The purpose of Redbook is to provide a set of guidelines for:</p> <ul style="list-style-type: none"> <li>Safe operation of the Integrated Transmission System (I.T.S.)</li> <li>Customer service</li> </ul>	<p>The Integrated Transmission System (ITS) is governed by a set of guidelines known as the Integrated Transmission System Electric System Operating Procedures, commonly known as the Redbook. The purpose of Redbook is to provide a set of guidelines for:</p> <ul style="list-style-type: none"> <li>Safe operation of the Integrated Transmission System (I.T.S.)</li> <li>Customer service</li> </ul>

			<ul style="list-style-type: none"> <li>Proper use and care for the System's lines and equipment</li> </ul>	<ul style="list-style-type: none"> <li>Proper use and care for the System's lines and equipment</li> </ul> <p>Conditions may arise which are not covered by these guidelines, or where a deviation from the guidelines may be necessary. Under such conditions, use sound judgment to ensure that no serious risks or hazards to employees or the public are involved.</p>
5.3			<p>Title: Hot Line Tag Orders</p> <p>Hot Line Tag Order: permission to work on, or in close proximity to, <b>ENERGIZED</b> equipment or lines. There may be situations where a GTC associate or system owner may need to acquire a hot line tag order.</p>	<p>Let's take a look at another type of specific switching order – hot line tag orders. A hot line tag order is defined as permission to work on, or in close proximity to, energized equipment or lines.</p> <p>There may be situations where a GTC associate or system owner may need to acquire a hot line tag order to safely perform work.</p>
5.4	5.4.1 5.4.2 5.4.3	Open AIM - tagged Tagged AIM switch handle to illustrate visible air gap.	<p>Title: Clearance</p> <p>Clearance: Permission to work on a line or apparatus that is isolated from all sources of energy supply.</p> <p>A qualified operator will need to secure a clearance:</p> <ul style="list-style-type: none"> <li>anytime personnel have to come between an open air boundary</li> <li>if work requires encroachment within MAD</li> </ul> <p>Each situation should be evaluated with a qualified operator to determine if a clearance may be required.</p>	<p>Since you are not authorized or qualified to operate ITS equipment, there are situations where you may need a qualified escort or make pre-arrangements with a qualified operator. In some situations, a clearance may be required in order to safely perform work on the ITS.</p> <p>A clearance is defined as permission to work on a line or apparatus that is isolated from all sources of energy supply and cannot be made hot without manually closing certain tagged disconnecting switches or other visible air, or SF6 gas gap.</p> <p>Since a clearance de-energizes and isolates the affected portion of a transmission line or substation, it mitigates the risk of an electrical contact. A clearance must be acquired anytime personnel have to come between an open air boundary. If work requires you to encroach within MAD, a clearance or hot line tag must be in place. This measure requires pre-arrangements.</p> <p>Keep in mind that there are many other situations when a clearance may be required, and a qualified operator should be consulted before work begins.</p>
5.5	5.5.1 5.5.2 5.5.3	Copy of a switching order.  Control Center with "Issuing Operator" over or beneath it.	<p>Title: Switching Orders</p> <p>The switching order procedure is a process by which permission is obtained to <b>change the status</b> of equipment or control schemes on the Integrated Transmission System.</p>	<p>The switching order procedure is a process by which permission is obtained to change the status of equipment or control schemes on the Integrated Transmission System.</p> <p>Switching orders are given by the GSOC Control Center and only provided to qualified operators. You may not execute a switching order with Substation Access Only status.</p>

		Field avatar with "Receiving Operator" over or beneath it.	Switching orders are given by the GSOC Control Center and <b>only</b> provided to <b>qualified</b> operators.	
5.6			Review question	Substation Access Only training gives you authority to enter GTC Transmission Line Right-of-Ways. a. True b. False  Answer: false
5.7			Review question	What is the purpose of the Redbook? a. To define ITS equipment b. To define the ITS equipment limitations c. To provide a set of guidelines for safe operation of the ITS d. None of the above  Answer: C
Section: Wrap-Up & Emergency Reporting				
6.1			Title: Wrap-Up  Always communicate with GTC personnel to ensure you have a proper scope of work and hazard information.  Involve qualified operators, as necessary.	Now that we've reviewed safe access and work considerations for energized substation environments, you should be prepared to complete authorized, non-electrical work in GTC's substations. Remember, always communicate with GTC personnel to ensure you have a proper scope of work and all necessary hazard information, and qualified operators are involved, as necessary.
6.2	missing	Emergency Reporting Procedures Screenshot	Title: GTC Emergency Reporting Procedures  Incident Reporting: All significant events causing bodily injury, illness, fatality, property damage, system damage or sabotage must be reported IMMEDIATELY.	Finally, to meet our safety commitment, it's critical that you know and follow GTC's incident and emergency procedures. Please take note of the following information.  If any incident occurs at a jobsite, resulting in bodily injury, illness, fatality, property damage, system damage or sabotage, it must be reported IMMEDIATELY.  The GTC Emergency Reporting Procedures are a list of things you need to do when certain accidents occur. It is important to know how to proceed when you are having an emergency.
6.3			If emergency assistance is needed, call 911. Then, contact the GSOC Transmission Control Center at 1-800-241-5375 or 770-270-7113.	If emergency assistance is needed, call 911. Then, contact the GSOC Transmission Control Center at 1-800-241-5375 or 770-270-7113.
Section: Conclusion				
7.1		Concluding slide	Title: Congratulations!  Your final step to secure qualification is to pass the 30-question exam located on your LMS dashboard.	Congratulations! You've now completed your Substation Access Only training.  Your final step to secure qualification is to pass the 30-question exam located on your LMS dashboard.

7.2		Exit Instructions	Title: Exit Instructions  To receive credit for viewing this course, you must exit properly. Click the Nav button to learn more.	Click Next to continue. Click the NAV button for more information. You may now exit this program. Thank you for your participation. To receive credit, you must exit properly.
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